In the claims:

1. (amended herein)A method of operating an ion source comprising providing a voltage signal to an anode at a first end of an ionization region of the ion source, providing a signal to a gas supply of the ion source to cause gas to be provided to ~~an~~the ionization region ~~of the ion source~~, providing a signal to a cathode at a second end of the ionization region opposite the first end ~~of the ion source~~ to cause electrons to be emitted by the cathode such that electrons emitted by the cathode are accelerated through the ionization region toward the anode to cause ionization of the gas, thereby producing an ion current, wherein the anode voltage signal comprises a voltage that accelerates ions of the ion current out of the second end of the ionization region and that modulates between a first voltage above a threshold and a second voltage below the threshold.

2. (original)A method according to claim 1 wherein the threshold is an ionization threshold.

3. (original)A method according to claim 2 further comprising setting the threshold and the frequency and duty cycle of the modulation such that the ion current is extinguished during the period when the anode voltage signal is below the threshold.

4. (original)A method according to claim 1 wherein the threshold is approximately 100 volts.

5. (original)A method according to claim 1 wherein the threshold is approximately 60 volts.

6. (original)A method according to claim 1 wherein the threshold is approximately 40 volts.

7. (original)A method according to claim 1 wherein the second voltage is approximately zero.

8. (original)A method according to claim 1 wherein the threshold is a fault condition threshold.

9. (original)A method according to claim 8 further comprising setting the threshold and the frequency and duty cycle of the modulation such that a fault condition is alleviated during the period when the anode voltage signal is below the threshold.

10. (original)A method according to claim 8 wherein the anode voltage signal modulates above and below a fault condition threshold only during the presence of the fault condition.

11. (original)A method according to claim 1 wherein the frequency of the voltage cycle is greater than 1 Hz.

12. (original)A method according to claim 11 wherein the frequency of the voltage cycle is greater than 10 Hz.

13. (original)A method according to claim 1 wherein the frequency of the voltage cycle is greater than 90 Hz.

14. (original)A method according to claim 1 wherein the anode voltage comprises a rectified mains signal.

15. (original)A method according to claim 1 wherein the anode voltage signal is unregulated.

16. (original)A method according to claim 1 further comprising providing a DC voltage to the anode.

17. (previously amended)A method according to claim 16 wherein the DC voltage is less than the threshold.

18. (amended herein)A control system for an ion source comprising an anode voltage generator, a gas supply signal generator and a cathode signal generator, wherein the anode voltage generator provides a voltage signal to an anode at a first end of an ionization region of the ion source, wherein the gas supply signal generator generates a signal to cause a gas to be provided to the~~an~~ ionization region of the ion source, wherein the cathode signal generator generates a signal to cause electrons to be emitted by a cathode at a second end of the ionization region opposite the first end~~of the ion source~~ such that electrons emitted by the cathode are accelerated through the ionization region toward the anode to cause ionization of the gas, and wherein the anode voltage generated comprises a voltage that accelerates ions out of the second end of the ionization region and that modulates between a first voltage above a threshold and a second voltage below the threshold.

19. (original)A control system according to claim 18 wherein the anode voltage generator comprises a circuit generating a mains rectified voltage.

20. (original)A control system according to claim 19 wherein the circuit generates a variable mains rectified voltage.

21. (original)A control system according to claim 19 wherein the circuit comprises a bridge rectifier.

22. (original)A control system according to claim 21 wherein the bridge rectifier comprises an anode voltage output and a ground, wherein the circuit further comprises a capacitor between the anode voltage output and ground.

23. (original)A control system according to claim 19 wherein the circuit further generates a DC voltage to the anode.

24. (original)A control system according to claim 23 wherein the DC voltage is less than the threshold.

25. (original)A control system according to claim 18 wherein the second voltage is approximately zero.

26. (original)A control system according to claim 18 wherein the threshold is less than 60 volts.

27. (original)A control system according to claim 18 wherein the frequency of the voltage cycle is greater than 1 Hz.

28. (original)A control system according to claim 18 wherein the frequency of the voltage cycle is greater than 10 Hz.

29. (original)A control system according to claim 18 wherein the frequency of the voltage cycle is greater than 90 Hz.

30. (amended herein)An ion beam system comprising an ion source head and a control system, the ion source head comprising an anode, an electron emitting cathode, an ionization region disposed between said anode and said cathode, and a gas supply adapted to provide an ionizable gas to the ionization region, the control system comprising an anode voltage generator, a gas supply signal generator and a cathode

signal generator, wherein the anode voltage generator provides a voltage signal to the~~an~~ anode ~~of the ion source~~, wherein the gas supply signal generator generates a signal to cause a gas to be provided to the~~an~~ ionization region ~~of the ion source~~, wherein the cathode signal generator generates a signal to cause electrons to be emitted by the~~a~~ cathode ~~of the ion source~~ such that electrons emitted by the cathode are accelerated through the ionization region toward the anode to cause ionization of the gas, and wherein the anode voltage generated comprises a voltage that accelerates ions out of the second end of the ionization region and that modulates between a first voltage above a threshold and a second voltage below the threshold.